DESIGN OF POWER PLANT AND HEATING SYSTEM FOR CAMP FUNSTON

BY

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ARMOUR INSTITUTE OF TECHNOLOGY

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DESIGN AND INSTALLATION OF POWER PLANT AND HEATING SYSTEM FOR THE ZONE OF CAMP ACTIVITIES AND AMUSEMENTS, CAMP FUNSTON, KANSAS

A THESIS

PRESENTED BY

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TO THE

PRESIDENT AND FACULTY

OF

ARMOUR INSTITUTE OF TECHNOLOGY

FOR THE DEGREE OF

MECHANICAL ENGINEER

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LIST OF ILLUSTRATIONS

PHOTOGRAPH OF THE ZONE OF CAMP ACTIVITIES AND AMUSEMENTS.

BLUE PRINT NUMBER ONE.

PLAN OF POWER PLANT....In Pocket on Rear Cover

BLUE PRINT NUMBER TWO.

POWER PLANT DETAILS. "

BLUE PRINT NUMBER THREE.

DETAILS OF POWER PLANT PIPING. "

BLUE PRINT NUMBER FOUR.

PLOT PLAN OF BLOCK NUMBER ONE. "

BLUE PRINT NUMBER FIVE.

PLOT PLAN OF BLOCK NUMBER TWO. "

BLUE PRINT NUMBER SIX.

PLOT PLAN OF BLOCK NUMBER THREE."

BLUE PRINT NUMBER SEVEN.

PLOT PLAN OF BLOCK NUMBER FOUR. "

OBJECT

The object of this thesis is to give the reader an insight into the problems which confront the engineer who is designing a central heating plant for a group of buildings, the character of which is not definitely known at the outset; and to show how those problems were handled in the design of a central heating plant for the Zone of Camp Activities and Amusements at Camp Funston, Kansas.

CHAPTER 1.

INTRODUCTION.

SYNOPSIS: A brief history of the project and a discussion of the problems to be solved.

HISTORY OF THE PROJECT:

In October 1917, the War Department authorized the construction of an amusement zone at Camp Funston, Kansas. A new department, called the Department of Camp Activities and Amusements, was organized for the purpose of preparing plans for the proposed zone and superintending its construction.

A plot of ground, 1092 feet long and 150 feet wide, near the center of the camp, was alloted for the Zone by the Camp Commander. This ground was divided up into four blocks, each 243 feet by 150 feet, separated by three fourty foot streets.

According to the War Department provisions, the Zone had to be built by civilian capital; so it was necessary to run it on the concession plan and to design the various buildings according to the needs of the concessionaires. The principal concessions contemplated by the Department of Camp Activities and Amusements were three theatres, each to have a capacity of 2,000 people, a large pool hall, barber shop, several restaurants, clothing stores and an arcade to contain about fifty small booths.

THE HEATING PROBLEM.

As winter was almost at hand, and as some of the concessionaires started work on their buildings long before all the space had been allotted for the different concessions, it was imperative that heat, light, water and sewers be provided for them as soon as possible. It was decided that a central heating plant and a vacuum system of heating would be the most economical to install, the cost to be paid by the different concessionaires in proportion to the service they would receive from it. The

number and character of the buildings which the plant would have to serve was largely a matter of conjecture, so the design had to be made with enough elasticity to provide for any future demands that might be made upon the plant.

THE ELECTRICAL PROBLEM.

The provisions to be made for electric current supply was one of the problems to be solved. The camp was supplied with current from three sources, Abilene, Junction City, and Manhattan, Kansas; but the combined capacity of these plants could hardly carry the load then being placed upon them. The architect's plans for the Zone buildings provided that the fronts be liberally sprinkled with lights, and the power requirements for motion picture machines, fans, etc. would be considerable.

The main question to be considered was whether it would be more economical to install generators and use the exhaust steam from the engines for heating, or to purchase the current from outside sources. As the maximum length of

time during which the Zone could be considered a paying proposition was five years, the first cost of installing generators proved prohibitive. Therefore, an agreement was reached with the various electric companies supplying the camp whereby they promised to enlarge their equipment to handle the Zone, and to run lighting and power lines to it at their expense. Provisions had to be made in the design of the plant, however, for the installation of generators in the future, in case it would become necessary.

THE WATER PROBLEM.

The question of water supply became quite a serious one. The camp derived its water supply from seven wells sunk near the Kansas River banks. The supply from these wells proved inadequate for the camp, so the authorities objected to the Zone drawing on it. It therefore became necessary to drill a well to supply the Zone, and as the surface water was used for the camp supply, a deep well through the bed rock was the only solution. This was drilled on the

power plant site, and provisions for the deep well pump and the pressure tank had to be made in the power plant building.

THE SEWER PROBLEM.

The main cantonment sewer line ran under the third block of the Zone (see sheet #6) at such a level that a good fall could be obtained by draining both ends of the Zone toward it. This made the sewage disposal problem a comparitively easy one to solve.

CHAPTER 2.

CALCULATIONS.

SYNOPSIS: An outline of the calculations necessary to determine the size of the boilers and auxiliaries of the power plant.

BOILERS.

The first thing to be decided upon in designing the plant was the boiler capacity necessary. To get an idea as to the capacity that would be required for the heating system, it was necessary to resort to a rule of thumb; i.e. for a temperature difference of ninety degrees between the inside and outside, fifty cubic feet of contents require about one square foot of radiation to heat them. Assuming that the average story height over the entire four blocks would be fifteen feet, the cubic contents of the buildings would be

$$4 \times 243 \times 150 \times 15 = 2{,}187{,}000 \text{ cu.ft.}$$

$$2{,}187{,}000 \div 50 = 43{,}740 \text{ sq.ft. of}$$

radiation and mains required for heating.

One square foot of radiation condenses on an average of .28 pound of steam per hour.

.28 x 43,740 = 12,247 pounds of steam to be evaporated per hour to supply the heating system.

A hot water heater capable of heating 3,000 gallons of water per hour (the estimated amount required) from fifty degrees F. to one hundred eighty degrees F. requires 525 pounds of steam per hour.

The demands for live steam for coffee urns, sterilizers, steam tables, etc. were estimated at about 300 pounds of steam per hour.

Therefore the total pounds of steam required for the above mentioned items would be

12,247 + 525 + 300 = 13,072 pounds.

The boiler feed and vacuum pumps were considered as requiring about 4% of the steam generated for other purposes, that is 4% of 13,072 pounds or 523 pounds of steam.

This made the total steam to be generated by the boilers 13,072 + 523 or 13,595 pounds.

Under ordinary conditions, a return tubular boiler evaporates approximately 30 pounds of steam per rated horsepower. Therefore the rated horsepower required for this plant would be 13,595 ÷ 30 = 453 or about 450 H.P.

In choosing the units to be installed, provisions had to be made to handle the hot water and live steam demands efficiently during the summer, when steam was not required for heating. Therefore it was decided that four 150 horsepower return tubular boilers be installed. This would give a capacity of 450 horsepower in three boilers, which could be run continuously in the coldest weather, and would still leave one boiler for emergency and cleaning purposes. During the summer months, one boiler would be sufficient to handle all the demands for hot water and live steam. In the design of the plant every provision was made for the addition of another 150 H.P. boiler in case it would become necessary to supply more steam than was originally calculated.

AUXILIARIES.

The sizes of all the power plant auxiliaries were determined with a veiw of handling a load of 750 H.P., so they would be large enough to handle the load in case another boiler were added in the future. The boiler feed and vacuum pumps were made large enough so one boiler feed and one vacuum pump could handle the entire load.

RADIATION.

The radiation necessary for the various buildings was calculated by the B.T.U. loss method to keep the temperature in the buildings at 70 degrees F. when the outside temperature was 20 degrees below zero F.

EQUIPMENT,

The following is a list of the principal equipment of the plant, as installed:

4 - 72"x 18'-0" Murray Horizontal Return Tubular Boilers

4 - #8 Gauge smoke stacks, diameter 34"; height above stack plate 60'-0".

2 - 10"x 14"x 12" Worthington Vacuum Pumps

2 - 10"x 6"x 10" Worthington Duplex Boiler Feed Pumps.

1 - 750 H.P. Webster Standard Feed Water Heater.

1 - Alberger Hot Water Heater having a capacity of raising 3000 gallons of water per hour from 50 degrees F. to 180 degrees F.

1 - Economy centrifugal Circulation pump direct connected to 2 H.P., 3 phase, 60 cycle, 220 volt motor.

2 - 5" Webster Suction Strainers.

2 - 1 1/2" Webster Vacuum Governors.

1 - 1 1/4" Low Pressure Steam Trap

1 - 1" High Pressure Steam Trap

1 - 1" Low Pressure Steam Trap.

1 - 24"x 72" Water Controlled Webster Air Separating Tank.

2 - 5"x 10" Pressure Reducing Valves

1 - 4" Pressure Reducing Valve

1 - 2" Pressure Reducing Valve

1 - 3" Powers Water Temperature Regulator

1 - 3" Back Pressure Valve

1 - 3" Exhaust Head

4 - 4" Crosby Pop Safety Valves

4 - One Quart Detroit Sight Feed Lubricators with double connection.

CHAPTER 3.

DESIGN.

SYNOPSIS: A description of the design of the power plant with reference to the blue prints in the pocket on the back cover of this book.

DESIGN OF THE POWER PLANT.

Blue print number one is a plan of the power plant showing the arrangement of the various units. A forty foot incline leads up to a platform from which the coal trucks dump the coal directly into the bins, which are in front of the boilers. No provisions were necessary for ash storage, as the ashes could be wheeled outside and utilized in road building.

A 6" lead from each boiler connects into a 12" drop header. From this header, two 10" leads are taken off for the heating system, a 3" line to the pumps, a 4" line to the hot water heater and an 1 1/2" high pressure steam supply line. An 8" plugged tee was left in the header for a possible future steam engine connection. The header is drained by a 1" high pressure steam trap, which discharges into a

line leading to the Feed water heater.

The boilers are fed through the blowoff connection, a detail of which appears on blueprint number three. There is also an emergency 1" cold water connection to the front of each boiler and a 2" line from the pressure tank to the rear of the boilers.

The 4" pop safety valves on the boilers discharge through the roof, and the discharge pipes are drained to the blow off tank.

The 2 1/2" blow off from each boiler is valved with two blow off valves and connects into a 3" blow off line, which empties into a 36" x 48" cast iron blow off tank placed under the floor (see detail on ~~xh~~ blue print #3). A 3" vent was run from the blow off tank through the roof and a 4" connection was made to the sewer.

Blue print number two shows a section through the power plant looking toward the side of the boilers, and also the boiler setting details.

Individual stacks were used for each

boiler. These stacks were 34" in diameter and 60'-0" high above the stack plates on the boilers, They were guyed at two points approximately 10'-0" and 30'-0" respectively from the tops. One half and three eights inch cable were used for guying the stacks and the cable was anchored to special supports placed in surrounding buildings and to posts, which in turn were guyed to dead men buried in the ground. Eight guy wires were used for each stack, and the stacks were fastened together by stays made of 3" pipe with the ends flattened and bolted to the bands around the stacks where the guy wires were fastened. The detail on blue print number two shows the type of hood used on each stack and the section (AA) shows the position of this hood.

Blue print number three shows several details of the connections to the pumps and hot water heater. The discharge from the circulating pump is by-passed to the air separating tank, so that in case the cantonment water supply were used, and the pressure were not enough to lift the water to the air separating tank, the

hot water circulating pump could act as a booster pump taking the water direct from the cold water line or from the hot water return and discharging it into the air separating tank.

The vacuum pumps were placed in a pit so the lift on the suction side would be reduced to a minimum. A by-pass which would allow the returns from the heating system to run directly to the sewer by gravity was installed at a manhole just outside the power plant (see blue print number six).

The exhaust from the boiler feed and vacuum pumps is piped to the open type feed water heated, where it is used to raise the temperature of the boiler feed water. The discharge from the traps bleeding the header, main steam mains and the hot water heater is also turned into the feed water heater through a special inlet for high pressure drips. There is also a 2" emergency live steam connection through a 2" pressure reducing valve from the pump steam supply line to the feed

water heater to heat the feed water in case there is not sufficient exhaust steam.

The feed water heater has a 3" connection passing through a spring type back pressure valve to the roof, where it is capped by an exhaust head which is drained to the air separating tank.

The various lines are so valved and by-passed that one half of the header can be shut down for repairs and steam can still be supplied to the mains and auxiliaries through the other half.

The pressure tank for the water supply was installed where the future generators, if put in later, would be placed. Arrangements were made, however, to bury the tank in the alley surrounding the power plant, in case the generators were installed.

CHAPTER 4.

INSTALLATION.

SYNOPSIS: A description of the method of installing the boilers and mains throughout the Zone. Blue prints referred to are in the pocket attached to the rear cover of this book.

BOILERS.

The first step in the installation of the power plant equipment was to put in the boiler foundations. It was found that the main cantonment sewer line ran directly under the spot selected for the boilers, but the foundations of the boilers were bridged in such a way that their weight was not supported by the sewer line. The boilers were placed on roller trucks and hauled from the railroad siding by a steam roller. They were blocked up on the foundations and the brickwork was started before the power plant building was built around them. The power plant equipment was installed as shown on blue prints nos, 1,2, and 3.

MAINS.

Blue prints numbers 4,5, 6 and 7 are plot plans of the four Zone blocks served by the central heating plant. On these plans are indicated the various steam, return and water lines and their approximate location. The main steam mains and hot water supply lines were run as much as possible overhead through the buildings and dropped into wood conduit only under the streets. The hot water and heating return lines were run in wood conduit in a trench about five feet in the rear of the Zone buildings. The cold water supply lines and local sewer mains were also run in the same trench. Whenever steam or hot water mains were exposed in the open, they were covered with 1" asbestos air cell pipe covering, 1 1/4" hair felt and tar paper.

In the various buildings the supply ends of the radiators, which were of the steam type, were equipped with Packless radiator valves, and the return ends with Webster Sylphon radiator ~~valves~~ traps. In most cases

the supply mains were run in the attic space over the buildings or near the first floor ceiling, and the return mains were covered and run underground in tile until they connected into the main return lines in the trench at the rear of the Zone. The steam mains were pitched about 1" in 20'-0" in the direction of the flow of steam, and wherever it was necessary to raise them they were dripped through Webster drip traps into the vacuum returns.

Expansion Joints and manholes were placed at various points. In most cases the steam mains were anchored at the ends of the blocks and the expansion joints were placed near the middle of the blocks.

As steam had to be supplied to some buildings remote from the power plant before other nearer buildings had even been started, it was necessary to leave plugged tees in all the service lines to take care of the additions and the pipe sizes had to be figured large enough to handle any load that might ~~be~~ be placed upon the mains.

CHAPTER 5.

CONCLUSION.

SYNOPSIS: A resume of the final result and the operation of the plant.

FINAL RESULTS.

When the Zone was finally completed, all the space allotted to it, with the exception of a space 50' x 72' in one corner of Block #4, was covered by buildings, (see accompanying photographs.)

The load on the power plant is as follows:

Direct radiation installed--	29,375	sq.ft.
Equivalent in direct radiation of mains,,,,.....	6,445	"
Equivalent in direct radiation of hot water heater....	1,870	"
Equivalent in direct radiation of high pressure steam.	1,100	"
Equivalent in direct radiation of pumps.....	1,550	"
Total load in equivalent direct radiation.....	40,339	sq.ft.

It can be seen from the above table that

the final load on the plant was not as great as the maximum provided for. It was found that two boilers were sufficient to handle the load for the larger portion of the winter, and three were required for only about two months of the coldest weather. A good steam circulation was kept up with less than one pound of steam pressure on the low pressure side of the pressure reducing valves and 5" vacuum on the vacuum returns. Fifty pounds gage pressure was kept on the boilers to run the pumps.

The occupants of the Zone seemed to be perfectly satisfied with the service they received, and the plant had ample capacity to meet the demands of the coldest weather.

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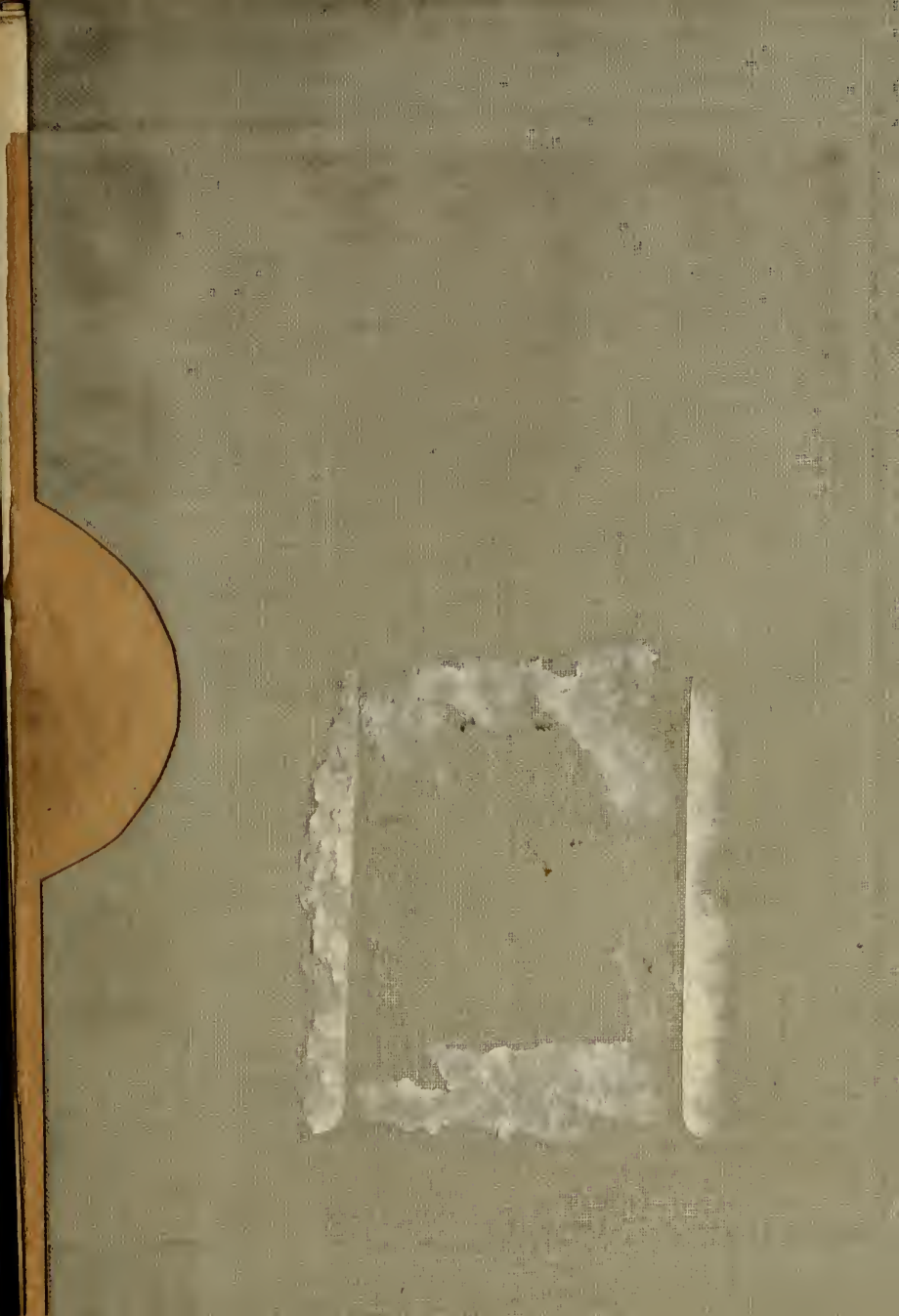
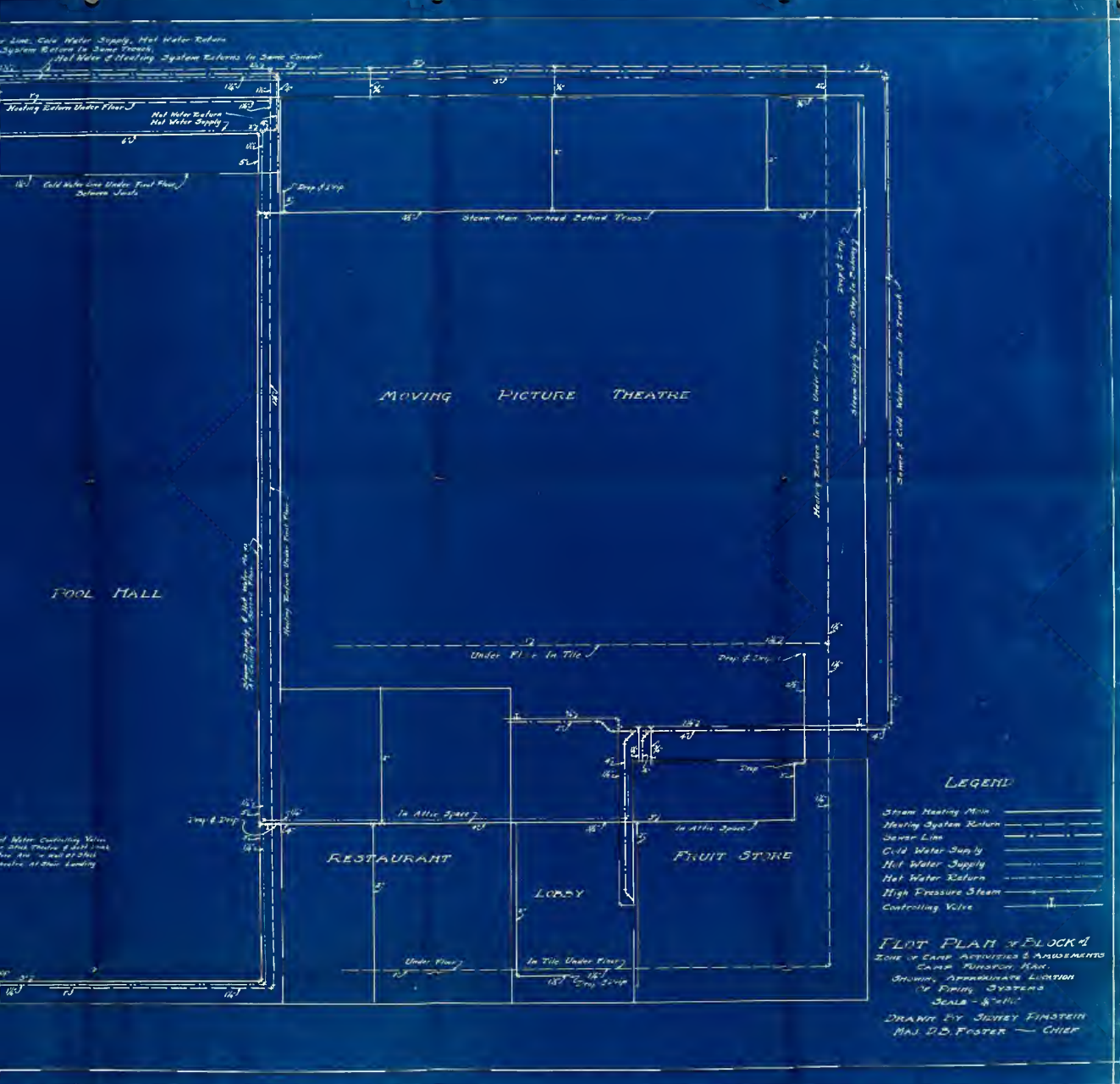
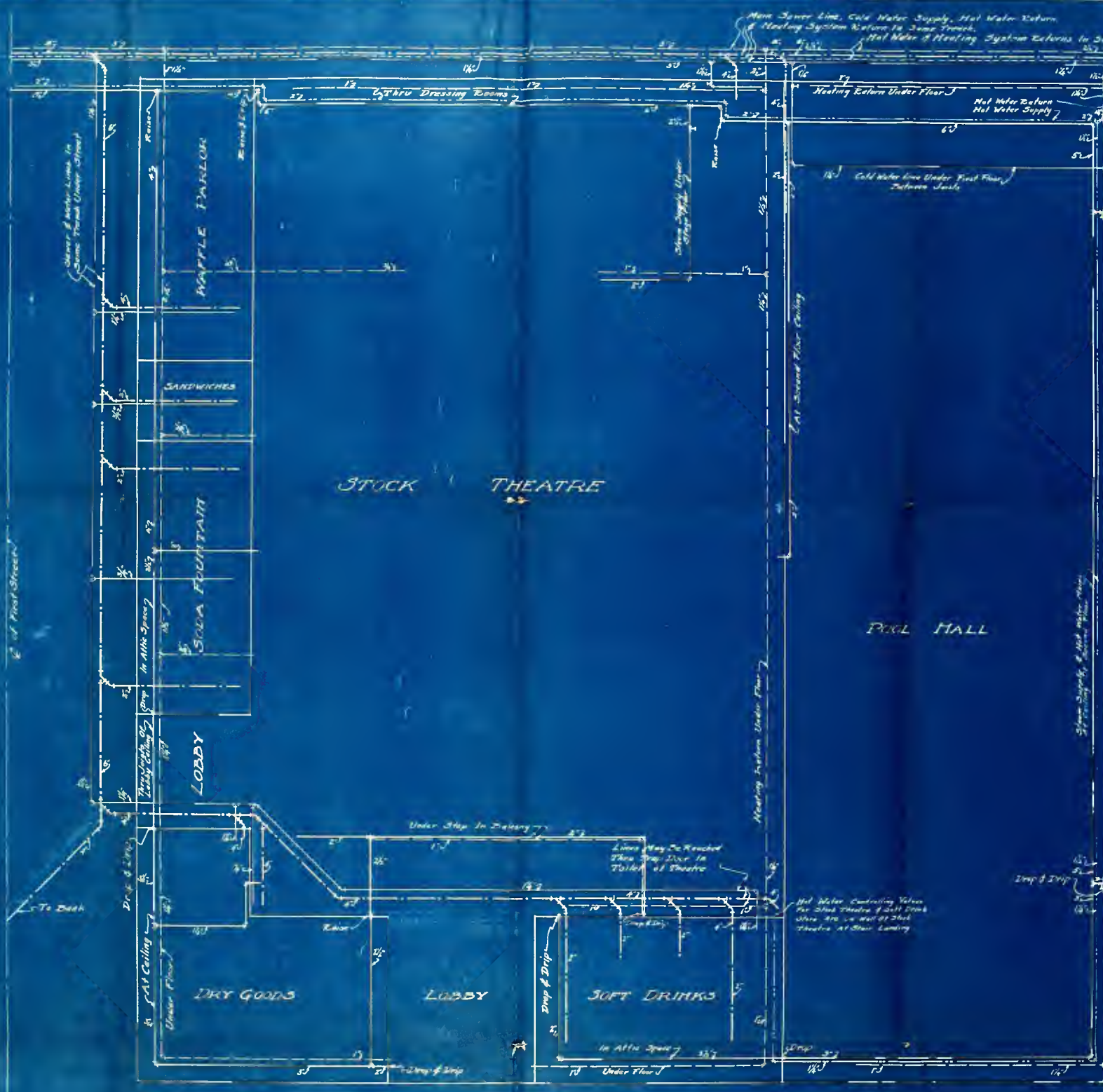
PHOTO BY
ANDERSON KC
The Zone
Camp Funston

FUNSTON
e Gone
Camp Funston, Kans.

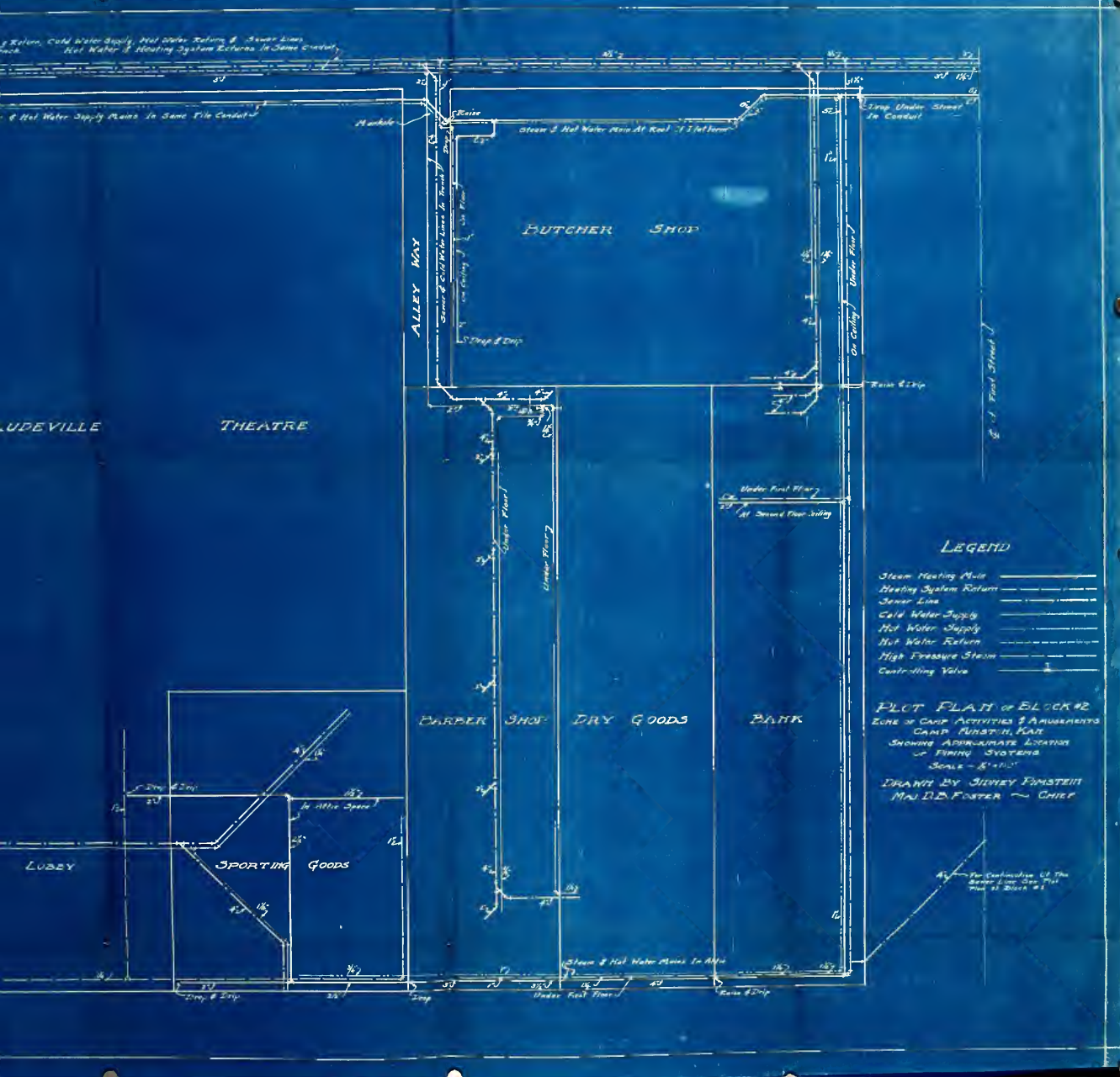




Cold Water Supply, Hot Water Return
System Return In Same Trench,
Hot Water & Heating System Returns In Same Conduit
Heating Return Under Floor
Hot Water Return
Hot Water Supply
Cold Water Line Under First Floor Between Joists
Drop & Drip
Steam Main Overhead Behind Truss
MOVING PICTURE THEATRE
Heating Return In Tile Under Floor
Steam Supply Under Step In Balcony
Sewer & Cold Water Lines In Trench
POOL HALL
Heating Return Under First Floor
Under Floor In Tile
Drop & Drip
In Attic Space
RESTAURANT
LOBBY
FRUIT STORE
Under Floor
In Tile Under Floor
LEGEND
Steam Heating Main
Heating System Return
Sewer Line
Cold Water Supply
Hot Water Supply
Hot Water Return
High Pressure Steam
Controlling Valve
PLOT PLAN OF BLOCK #1
ZONE OF CAMP ACTIVITIES & AMUSEMENTS
CAMP FUNSTON, KAN.
SHOWING APPROXIMATE LOCATION
OF PIPING SYSTEMS
DRAWN BY SIDNEY PIMSTEIN
MAJ. D.B. FOSTER — CHIEF



Main Sewer Line, Cold Water Supply, Hot Water Return & Heating System Return In Same Trench.
Thru Dressing Rooms
Heating Return Under Floor
Hot Water Return
Hot Water Supply
Cold Water Line Under First Floor Between Joists
Sewer & Water Lines In Same Trench Under Street
Raise
WAFFLE PARLOR
SANDWICHES
SODA FOUNTAIN
LOBBY
STOCK THEATRE
POOL HALL
At Second Floor Ceiling
Heating Return Under Floor
Drop In Attic Space
Thru Joists Of Lobby Ceiling
Under Step In Balcony
Lines May Be Reached Thru Trap Door In Toilet of Theatre
Hot Water Controlling Valves For Stock Theatre & Soft Drink Store Are On Wall At Stock Theatre At Stair Landing
To Bank
Drop & Drip
At Ceiling
Under Floor
DRY GOODS
LOBBY
SOFT DRINKS
In Attic Space
Under Floor



Hot Water & Heating System Returns In Same Conduit
Hot Water Supply Mains In Same Tile Conduit
Manhole
Raise
Steam & Hot Water Main At Roof Of Platform
Drop Under Street In Conduit
BUTCHER SHOP
ALLEY WAY
Sewer & Cold Water Lines In Trench
On Ceiling
Under Floor
Drop & Drip
Raise & Drip
First Street
UDEVILLE
THEATRE
Under First Floor
At Second Floor Ceiling
Under Floor
Under Floor
LEGEND
Steam Heating Main
Heating System Return
Sewer Line
Cold Water Supply
Hot Water Supply
Hot Water Return
High Pressure Steam
Controlling Valve
BARBER SHOP
DRY GOODS
BANK
PLOT PLAN OF BLOCK #2
ZONE OF CAMP ACTIVITIES & AMUSEMENTS
CAMP FUNSTON, KAN
SHOWING APPROXIMATE LOCATION OF PIPING SYSTEMS
DRAWN BY SIDNEY PIMSTEIN
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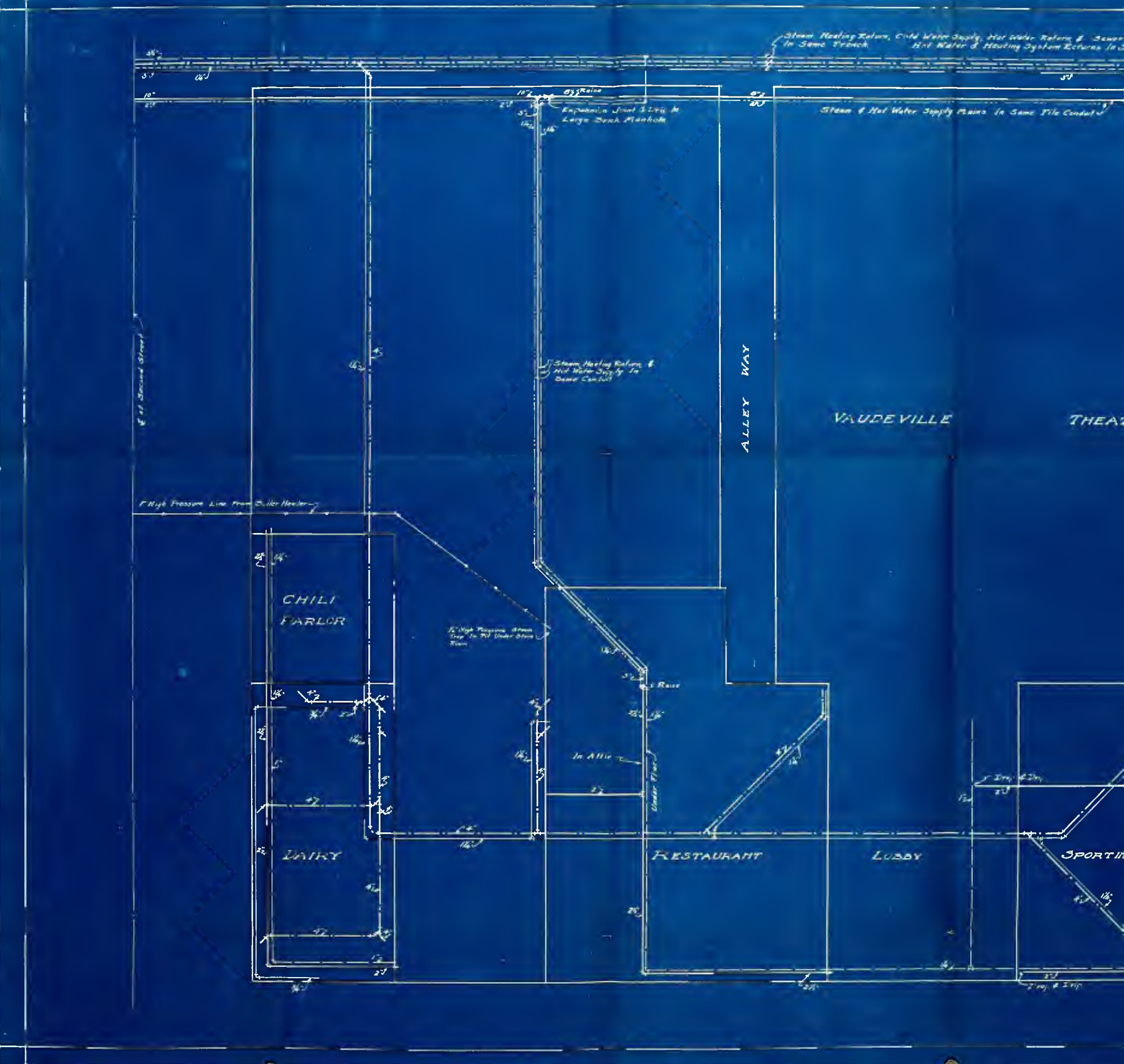
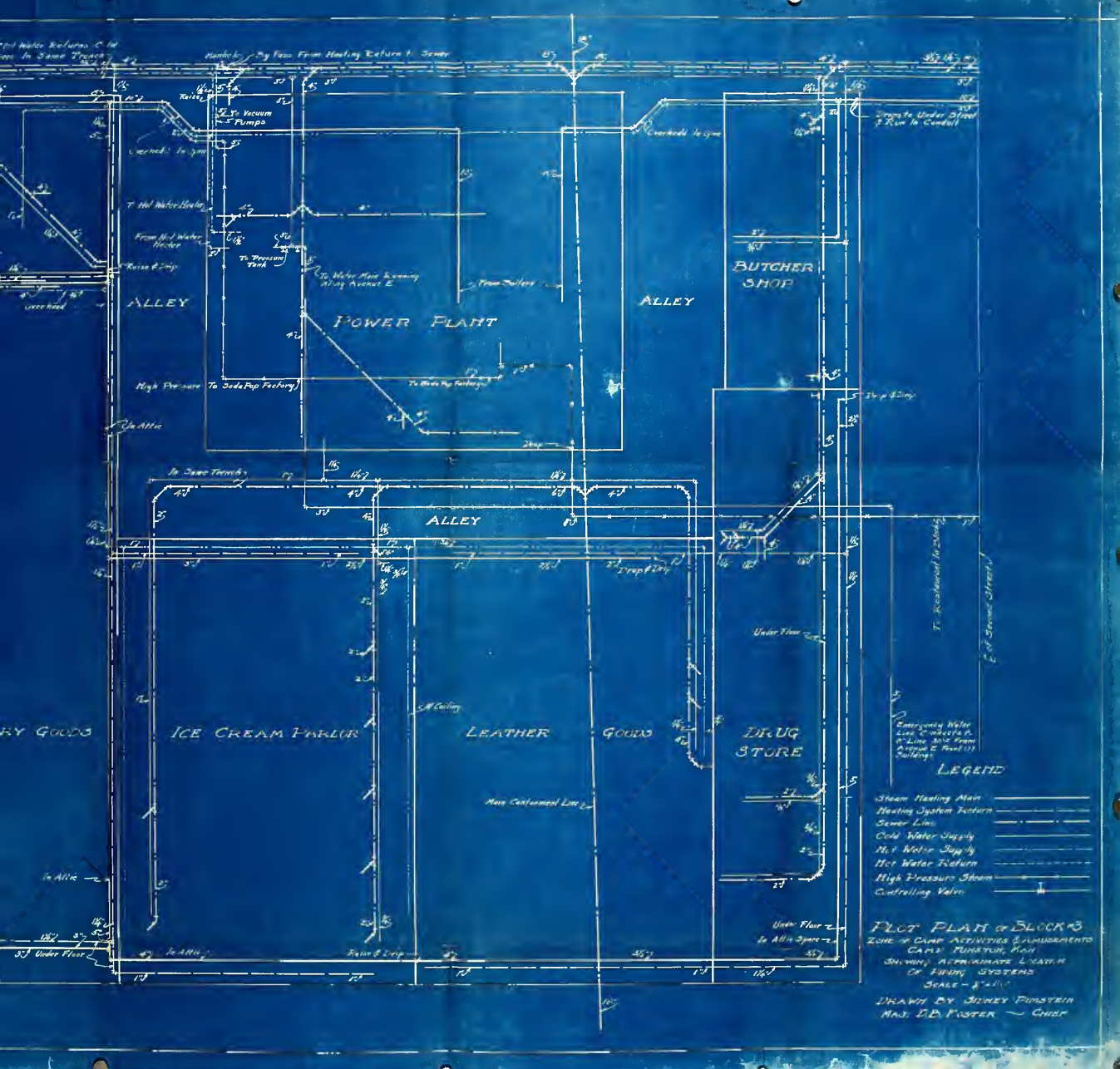
Drop & Drip
In Attic Space
LUBBY
SPORTING GOODS
Steam & Hot Water Mains In Attic
Drop & Drip
Drop
Under First Floor
Raise & Drip


Steam Heating Return, Cold Water Supply, Hot Water Return & Sewer In Same Trench
Hot Water & Heating System Returns In
Expansion Joint & Trap In Large Brick Manhole
Steam & Hot Water Supply Mains In Same Tile Conduit
Steam Heating Return & Hot Water Supply In Same Conduit
ALLEY WAY
VAUDEVILLE
THEA
High Pressure Line From Boiler Header
CHILI PARLOR
In Attic
Under Floor
DAIRY
RESTAURANT
LOBBY
SPORTIN



Hanhole
By Pass From Heating Return to Sewer
Raise
To Vacuum Pumps
Overhead In Open
To Hot Water Heater
From Hot Water Heater
To Pressure Tank
To Water Main Running Along Avenue E
From Boilers
Raise & Drip
Overhead
ALLEY
POWER PLANT
ALLEY
BUTCHER SHOP
Drops to Under Street & Run In Conduit
High Pressure To Soda Pop Factory
To Soda Pop Factory
Drop
In Attic
In Same Trench
ALLEY
Drop & Drip
Under Floor
To Restaurant In Block
Emergency Water Line Connects to 8" Line 30'-0" From Avenue E Front Of Buildings
RY GOODS
ICE CREAM PARLOR
LEATHER GOODS
DRUG STORE
Main Cantonment Line
In Attic
Under Floor
In Attic Space
Raise & Drip
LEGEND
Steam Heating Main
Heating System Return
Sewer Line
Cold Water Supply
Hot Water Supply
Hot Water Return
High Pressure Steam
Controlling Valve
PLOT PLAN OF BLOCK #3
ZONE OF CAMP ACTIVITIES & AMUSEMENTS
CAMP FUNSTON, KAN
SHOWING APPROXIMATE LOCATION OF PIPING SYSTEMS
DRAWN BY SIDNEY PIMSTEIN
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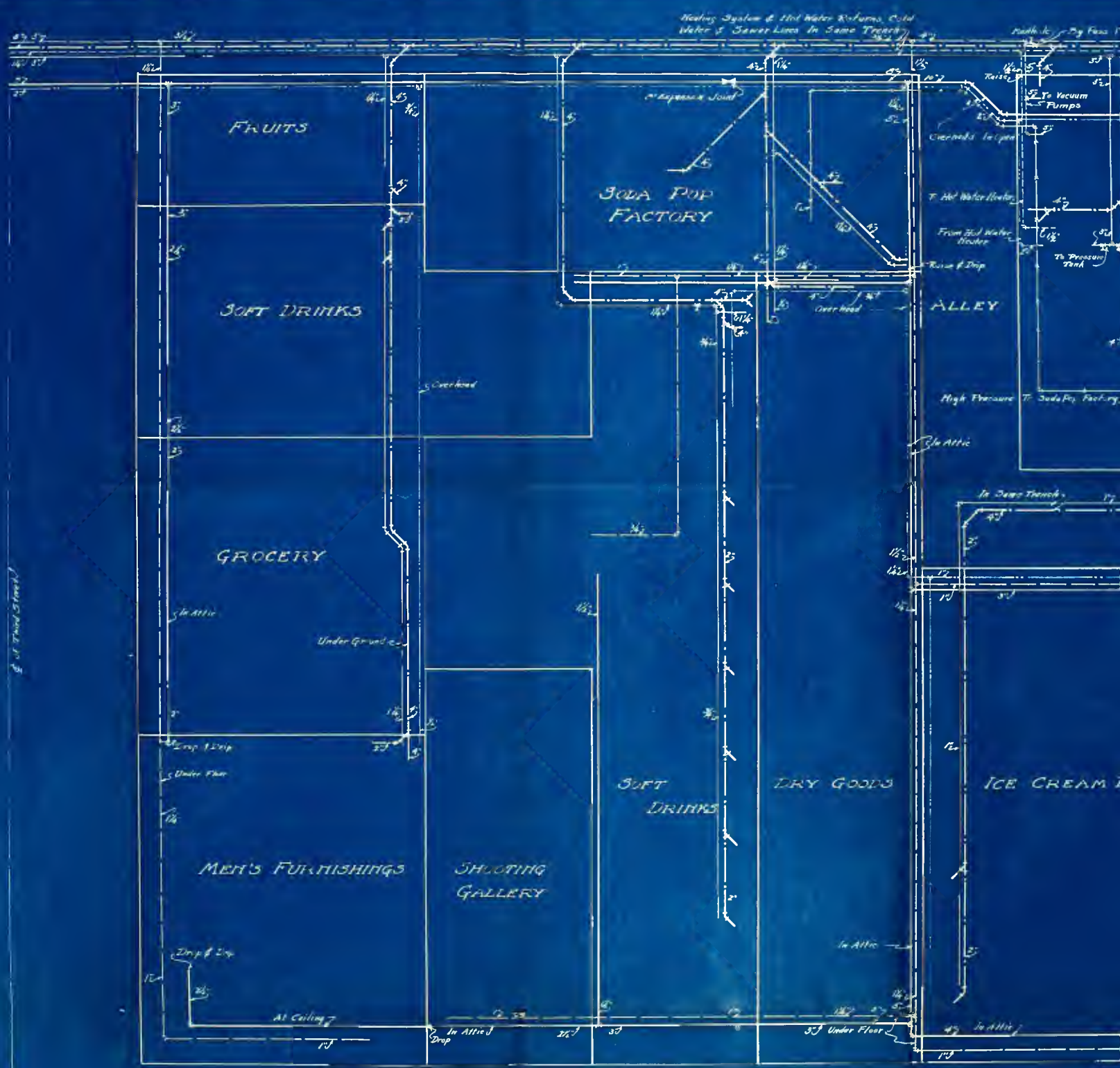
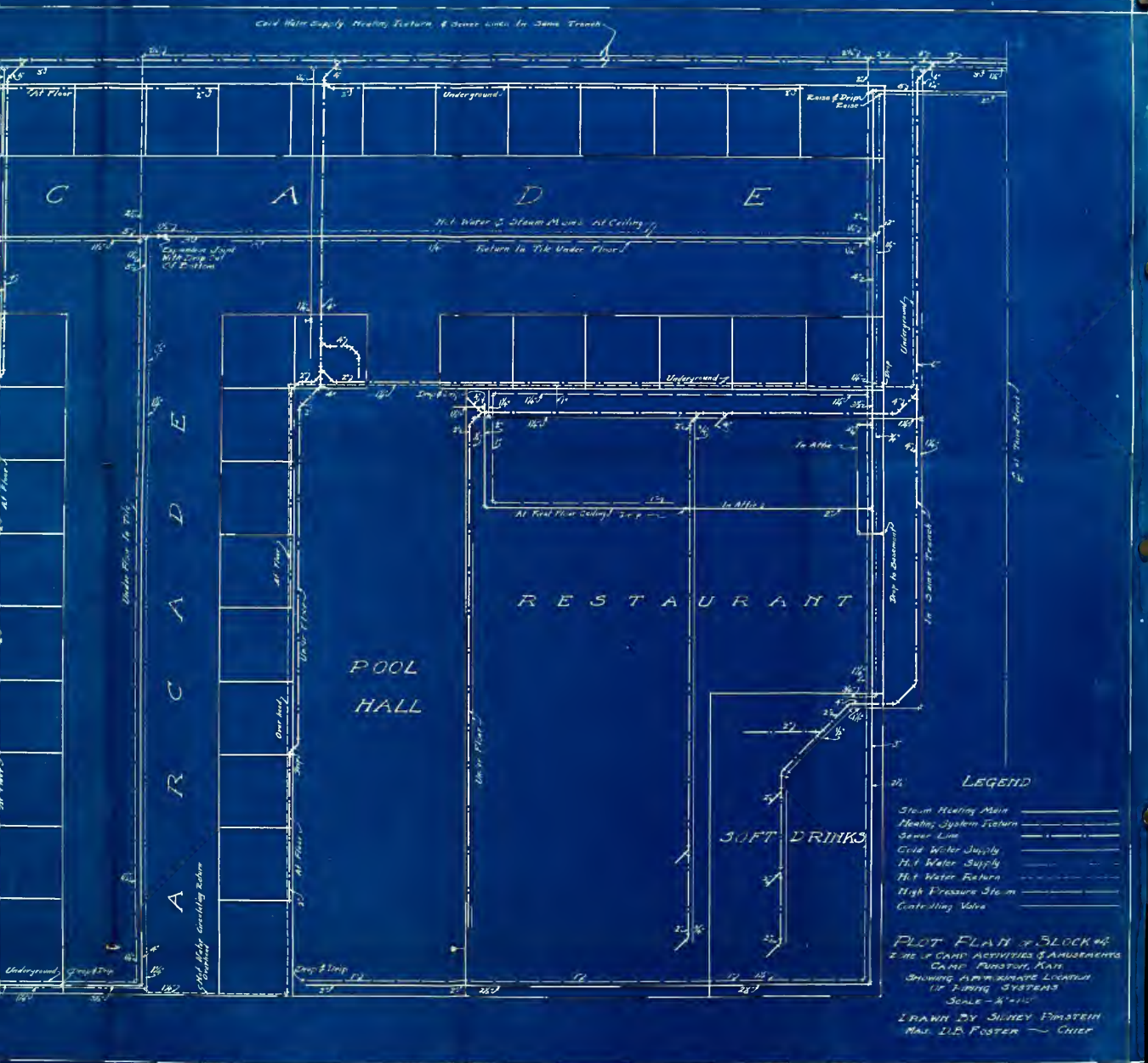


Heating System & Hot Water Returns, Cold Water & Sewer Lines In Same Trench
Manhole
By Pass
Raise
To Vacuum Pumps
Overhead In Open
T. Hot Water Heater
From Hot Water Heater
To Pressure Tank
Raise & Drip
Overhead
ALLEY
High Pressure To Soda Pop Factory
In Attic
In Same Trench
FRUITS
SODA POP FACTORY
SOFT DRINKS
Overhead
GROCERY
In Attic
Under Ground
Drop & Drip
Under Floor
MEN'S FURNISHINGS
SHOOTING GALLERY
SOFT DRINKS
DRY GOODS
ICE CREAM
In Attic
Drop & Drip
At Ceiling
In Attic
Drop
Under Floor
In Attic


Cold Water Supply Heating Return & Sewer Lines In Same Trench
At Floor
Underground
Raise & Drip Raise
C A D E
Hot Water & Steam Mains At Ceiling
Return In Tile Under Floor
Expansion Joint With Drip Out Of Bottom
Underground
Drop
In Attic
At First Floor Ceiling
Drop to Basement
In Same Trench
At Thin Street
RESTAURANT
POOL HALL
SOFT DRINKS
Under Floor In Tile
At Floor
Over head
Hot Water Circulating Return Overhead
Drop & Drip
LEGEND
Steam Heating Main
Heating System Return
Sewer Line
Cold Water Supply
Hot Water Supply
Hot Water Return
High Pressure Steam
Controlling Valve
PLOT PLAN OF BLOCK #4
ZONE OF CAMP ACTIVITIES & AMUSEMENTS
CAMP FUNSTON, KAN.
SHOWING APPROXIMATE LOCATION OF PIPING SYSTEMS
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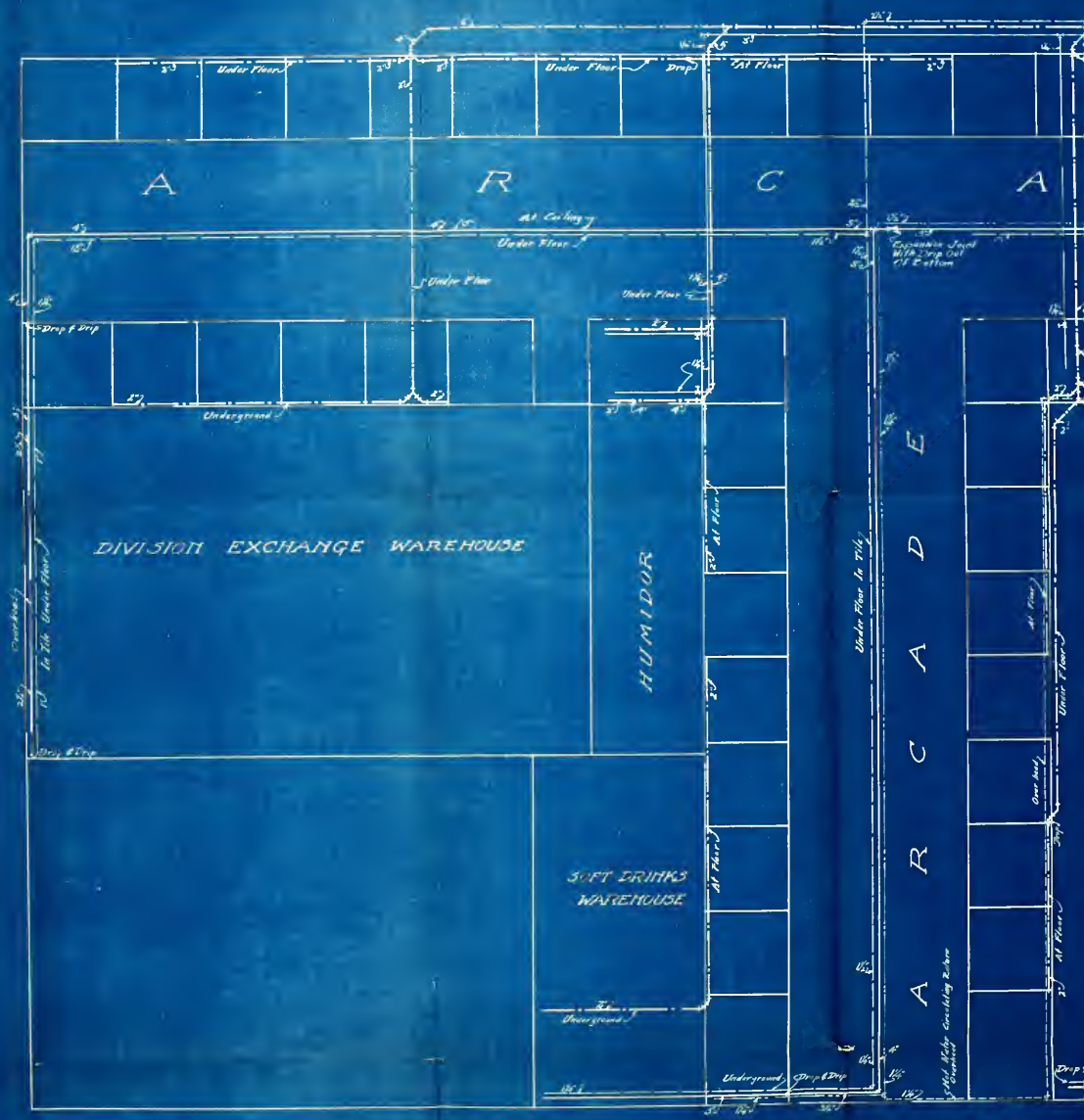
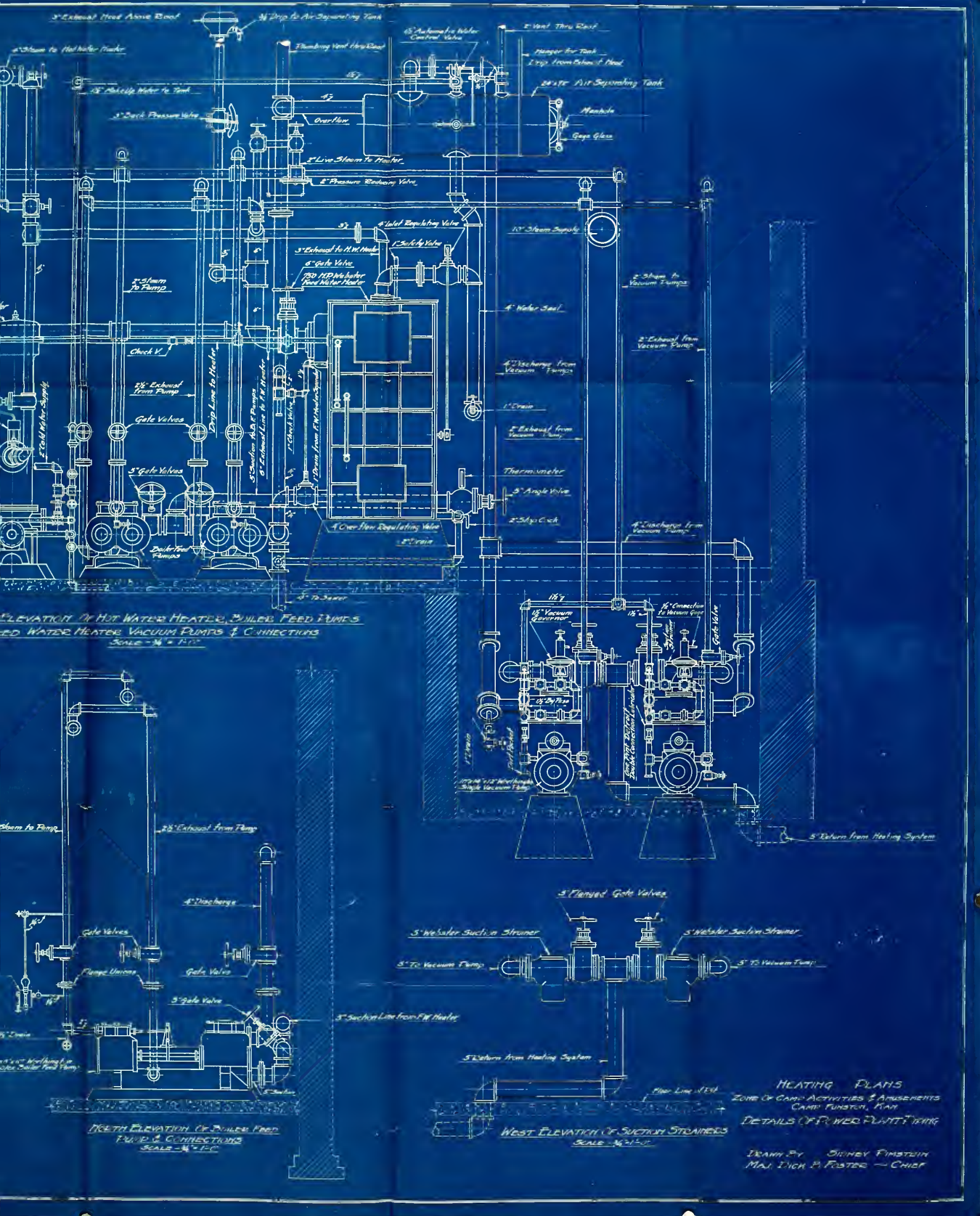
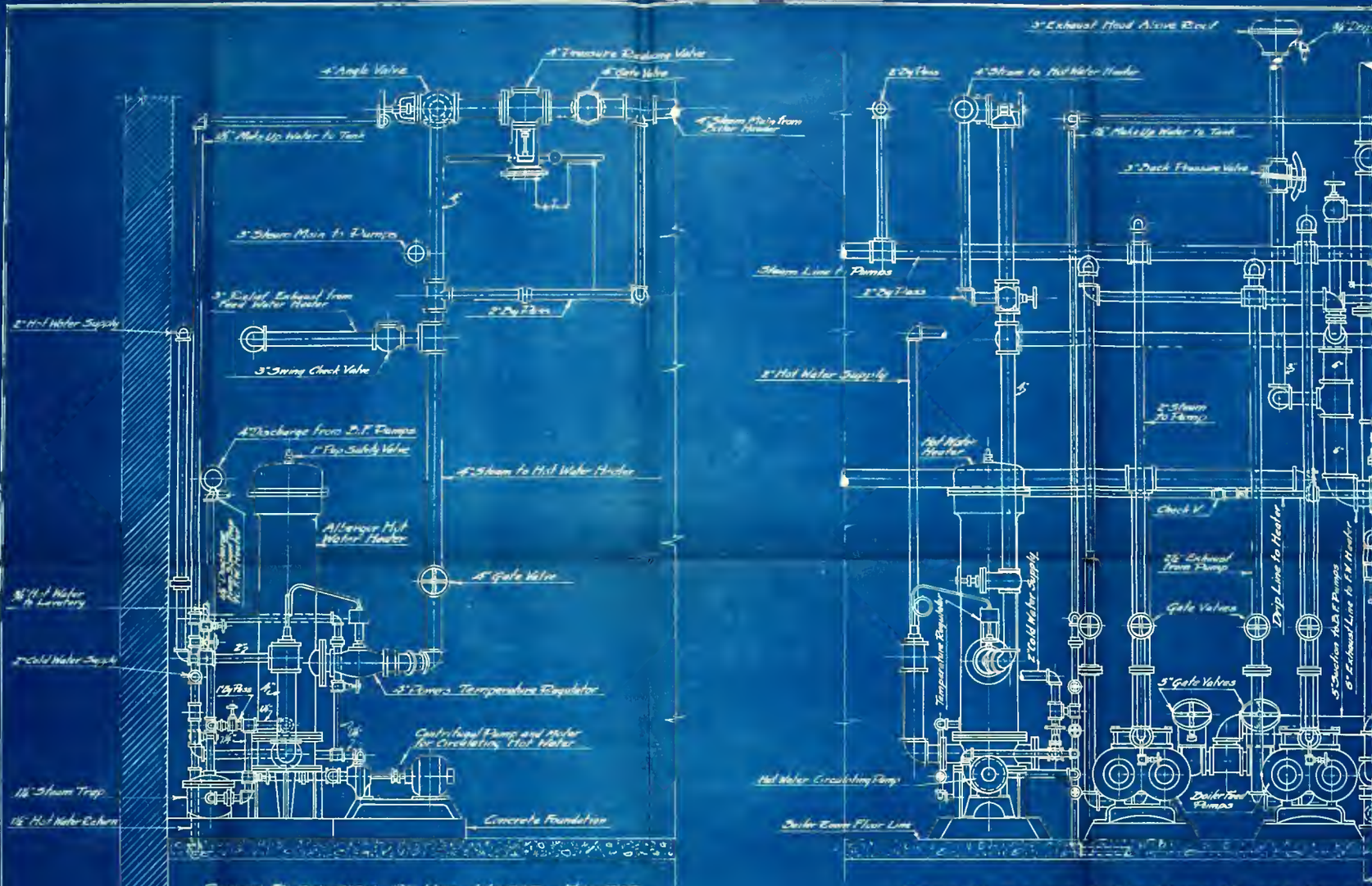

Cold Water Supp
Under Floor
Drop
At Floor
A R C A
At Ceiling
Expansion Joint With Drip Out Of Bottom
Drop & Drip
Underground
DIVISION EXCHANGE WAREHOUSE
HUMIDOR
Under Floor In Tile
A R C A D E
SOFT DRINKS WAREHOUSE
Drip & Drip

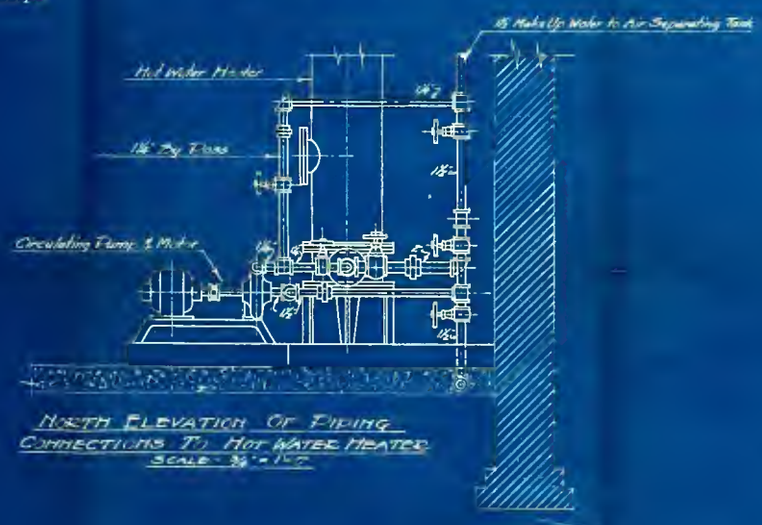


3" Exhaust Head Above Roof
3/4" Drip to Air Separating Tank
4" Steam to Hot Water Heater
Plumbing Vent thru Roof
1 1/2" Automatic Water Control Valve
2" Vent Thru Roof
Hanger for Tank
Drip from Exhaust Head
24"x72" Air Separating Tank
1 1/2" Make Up Water to Tank
3" Back Pressure Valve
Overflow
Manhole
Gage Glass
2" Live Steam to Heater
2" Pressure Reducing Valve
4" Inlet Regulating Valve
10" Steam Supply
3" Exhaust to H.W. Heater
1" Safety Valve
6" Gate Valve
150 H.P. Webster Feed Water Heater
2" Steam to Pump
2" Steam to Vacuum Pumps
4" Water Seal
Check V.
2" Exhaust from Vacuum Pump
4" Discharge from Vacuum Pumps
2 1/2" Exhaust from Pump
Drip Line to Heater
1" Drain
Gate Valves
2" Exhaust from Vacuum Pump
2" Cold Water Supply
5" Suction to B.F. Pumps
6" Exhaust Line to F.W. Heater
1" Check Valve
1" Drain from F.W. Heater Supply
Thermometer
5" Gate Valves
5" Angle Valve
2" Stop Cock
4" Overflow Regulating Valve
2" Drain
4" Discharge from Vacuum Pump
Boiler Feed Pumps
4" To Sewer
ELEVATION OF HOT WATER HEATER, BOILER FEED PUMPS
FEED WATER HEATER VACUUM PUMPS & CONNECTIONS
SCALE - 3/4" = 1'-0"
1 1/2" Vacuum Governor
1 1/2" Connection to Vacuum Gage
Gate Valve
1 1/2" By Pass
1" Drain
Duff Pocket
Single Vacuum Pump
5" Return from Heating System
Steam to Pump
2 1/2" Exhaust from Pump
4" Discharge
Gate Valves
Flange Unions
Gate Valve
5" Gate Valve
5" Suction Line from F.W. Heater
5" Flanged Gate Valves
5" Webster Suction Strainer
5" Webster Suction Strainer
5" To Vacuum Pump
5" To Vacuum Pump
5" Return from Heating System
Floor Line of Pit
NORTH ELEVATION OF BOILER FEED PUMP & CONNECTIONS
SCALE - 3/4" = 1'-0"
WEST ELEVATION OF SUCTION STRAINERS
SCALE - 3/4" = 1'-0"
HEATING PLANS
ZONE OF CAMP ACTIVITIES & AMUSEMENTS
CAMP FUNSTON, KAN.
DETAILS OF POWER PLANT PIPING
DRAWN BY SIDNEY PIMSTEIN
MAJ. DICK B. FOSTER — CHIEF



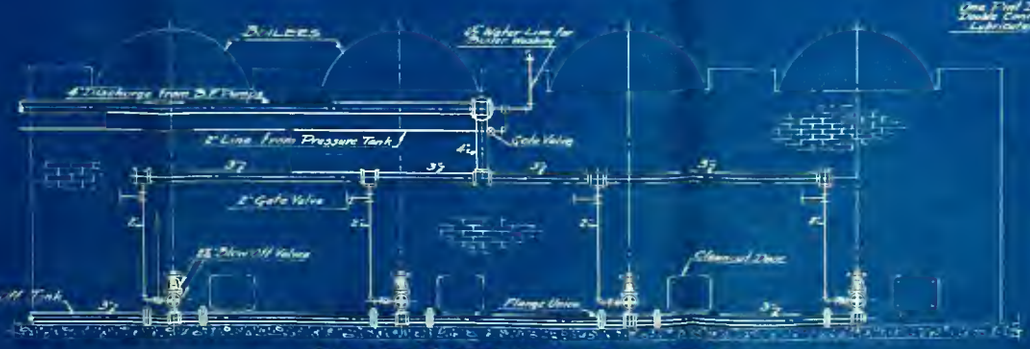
SOUTH ELEVATION OF HOT WATER HEATER AND PIPING CONNECTIONS
SCALE - ⅜" = 1'-0"

EAST ELEVATION OF HOT WATER HEATER, BOILER, FEED WATER HEATER VACUUM PUMPS & CONNE
SCALE - ⅜" = 1'-0"

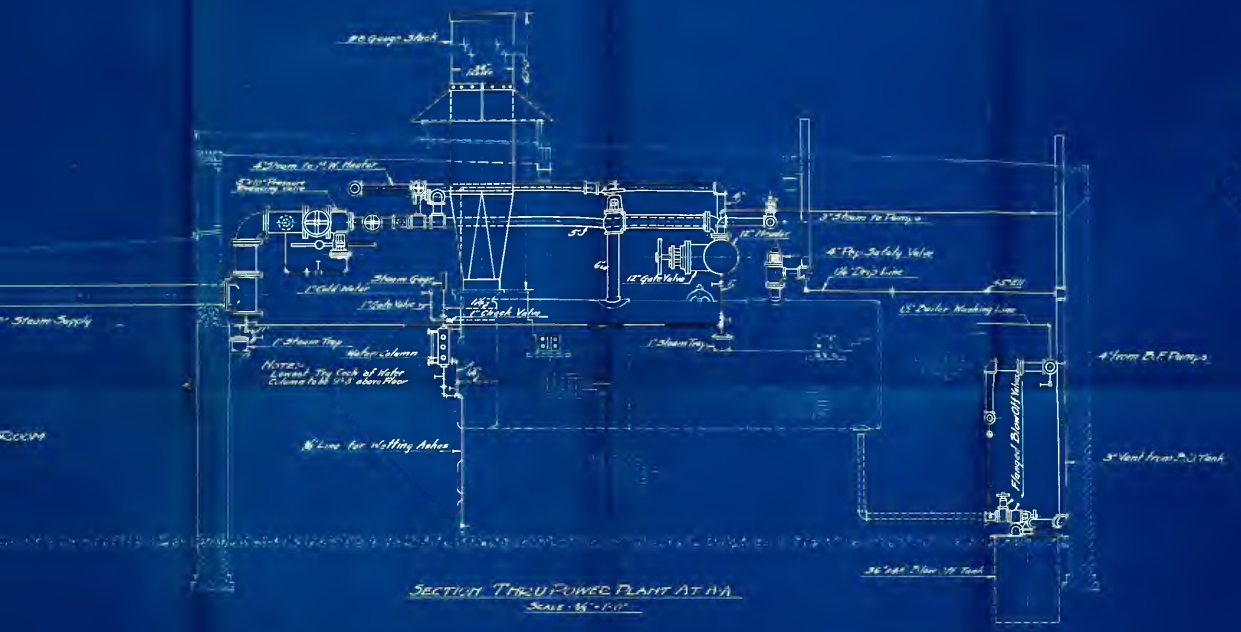


NORTH ELEVATION OF PIPING CONNECTIONS TO HOT WATER HEATER
SCALE - ⅜" = 1'-0"

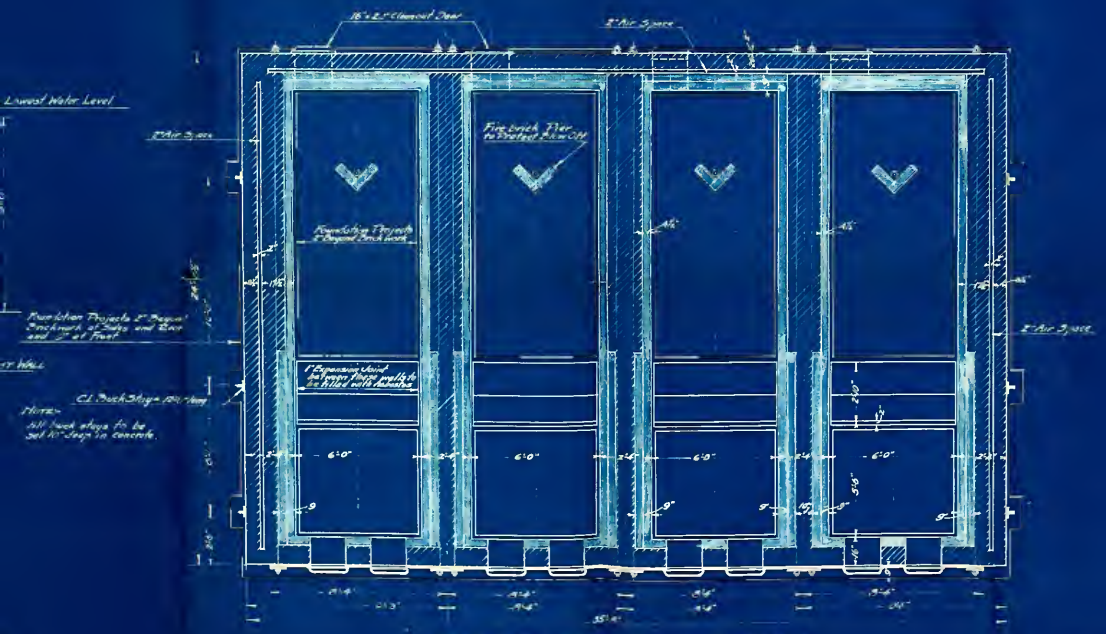
NORTH ELEVATION OF BOILER FEED PUMP & CONNECTIONS
SCALE - ⅜" = 1'-0"



BLOW OFF & FEED WATER CONNECTIONS AT REAR OF BOILERS
SCALE - ⅜" = 1'-0"



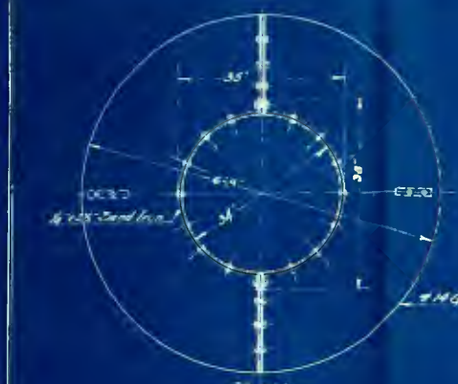
SECTION THRU POWER PLANT AT AA
SCALE: 1/4" = 1'-0"

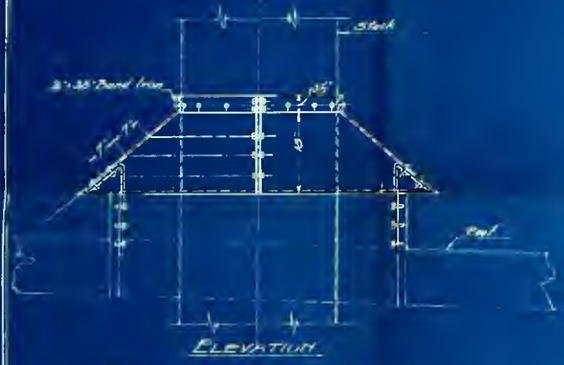


PLAN OF BOILERS SECTION TAKEN AT A-A
SCALE: 1/4" = 1'-0"

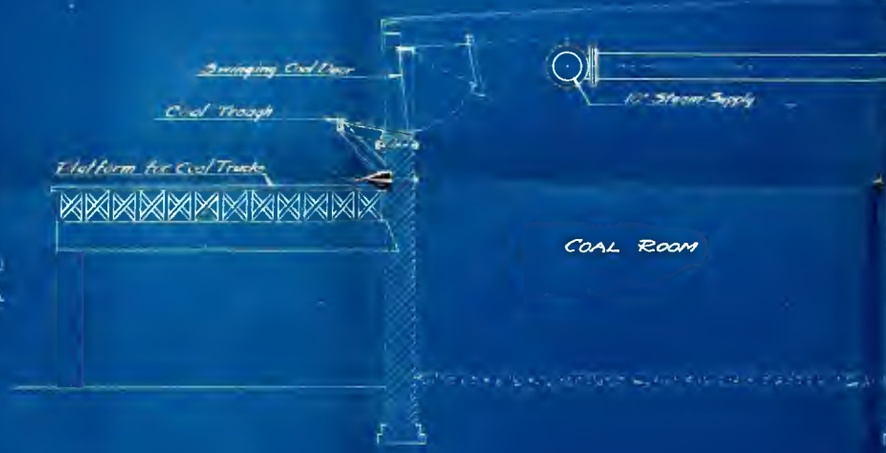
HEATING PLANS
ZONE OF CAMP ACTIVITIES & AMUSEMENTS
CAMP FUNSTON, KAN.
POWER PLANT DETAILS

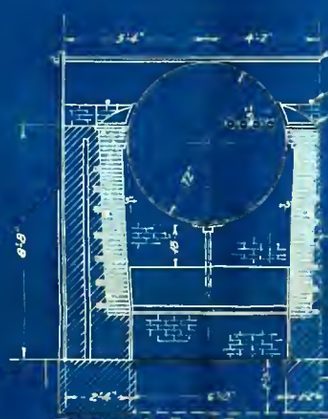
DRAWN BY SIDNEY FINSTEIN
MAJ. TICK P. FOSTER — CHIEF



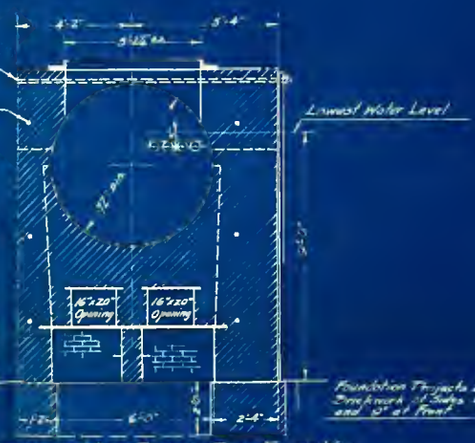


DETAIL OF STACK

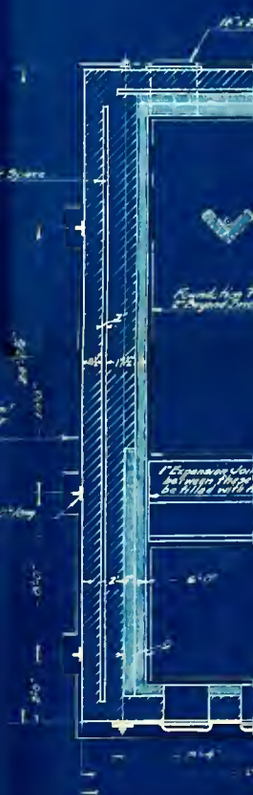


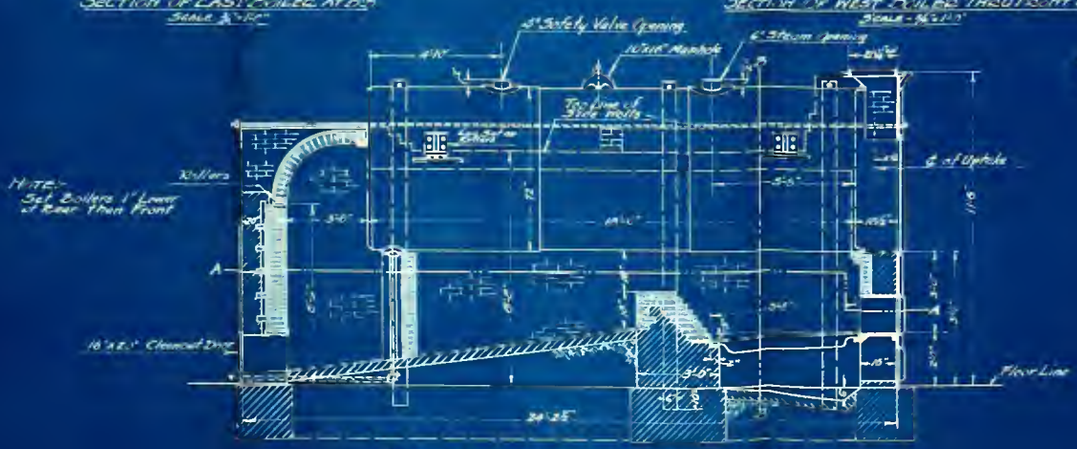


SECTION OF EAST BOILER AT B-B

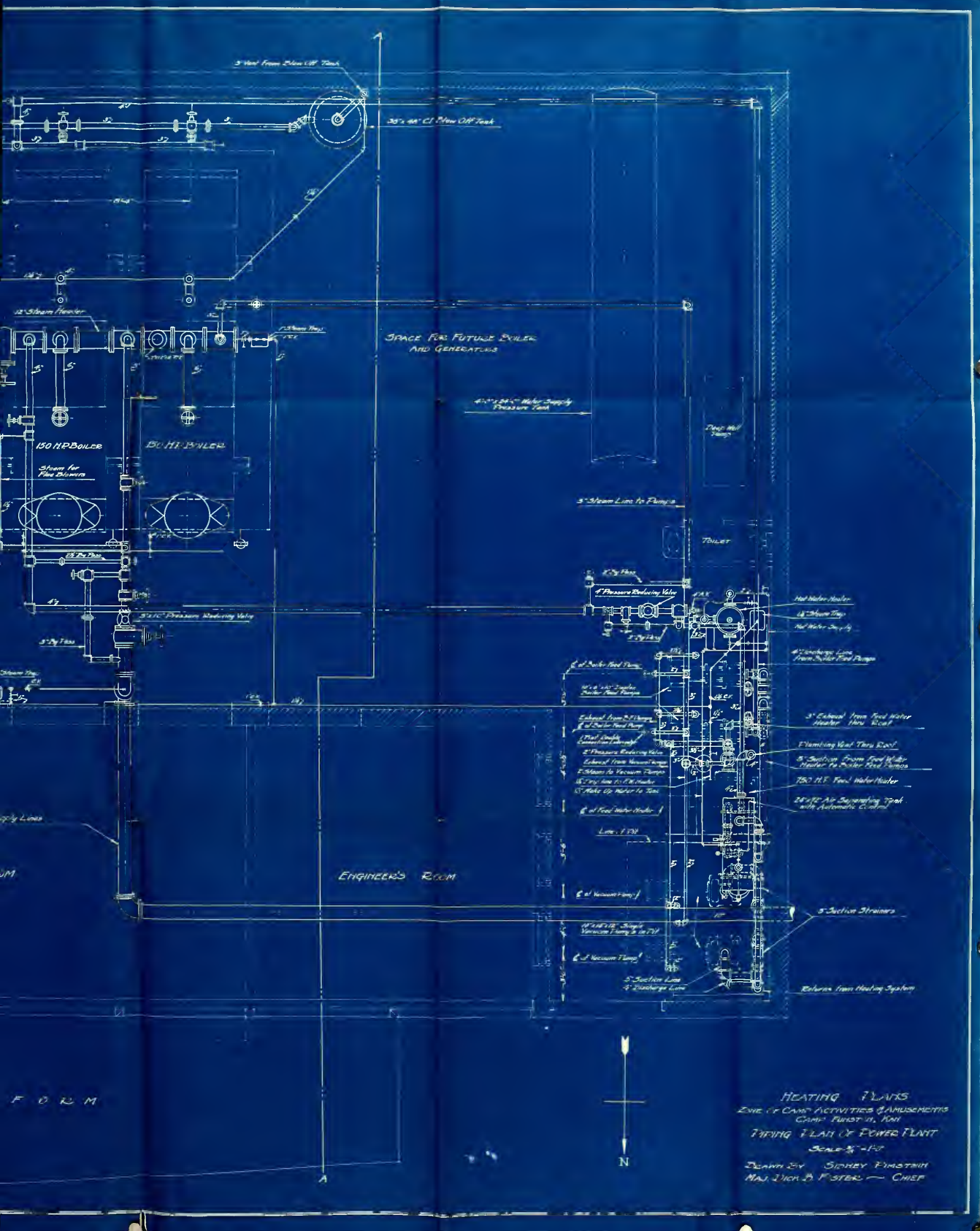


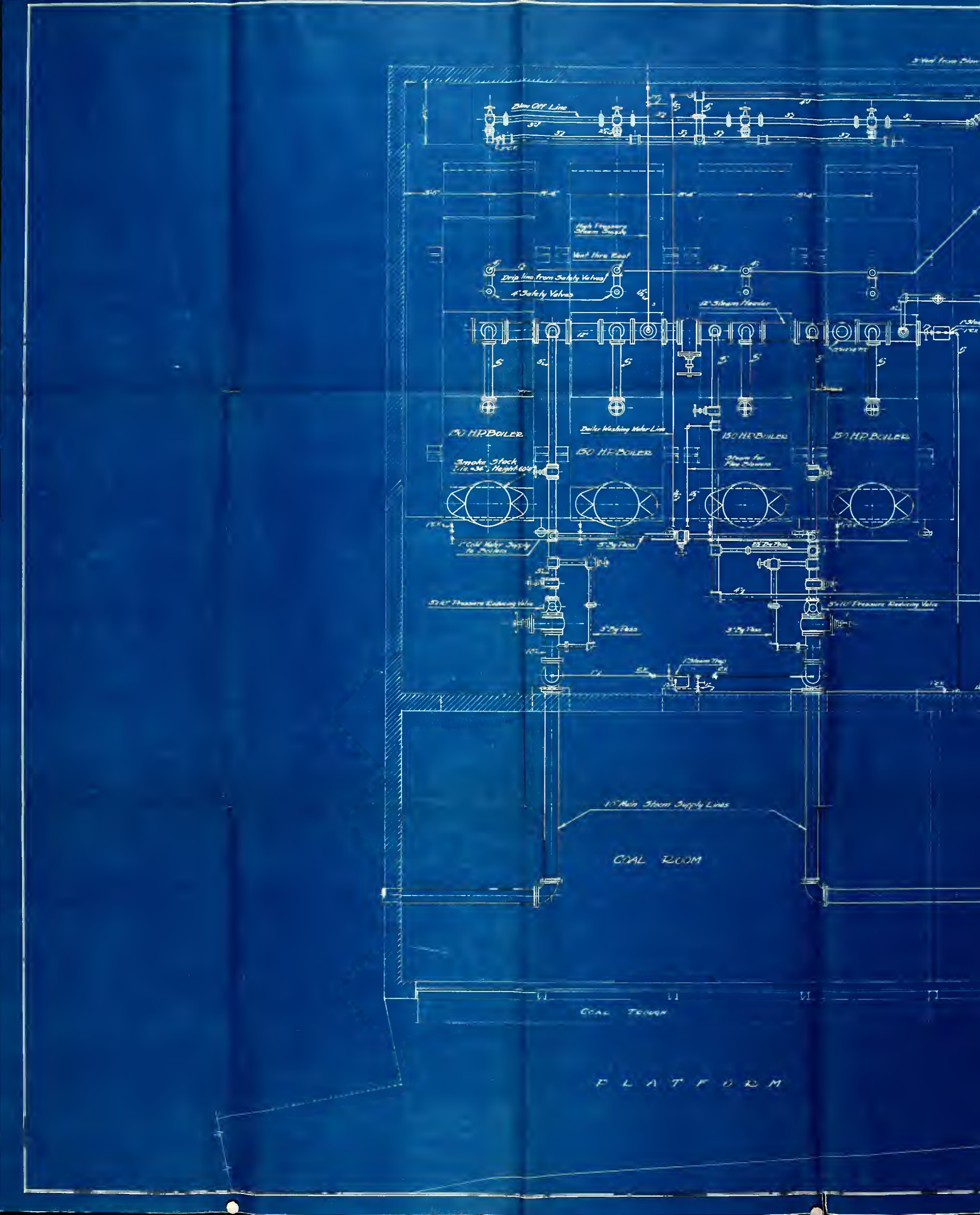
SECTION OF WEST BOILER THRU FRONT WALL





TYPICAL LONGITUDINAL SECTION THRU BOILERS


3" Vent from Blow Off Tank
36"x 44" CI Blow Off Tank
12" Steam Header
Space For Future Boiler And Generators
150 HP Boiler
150 HP Boiler
Steam for Fire Blower
3" Steam Line to Pumps
Toilet
4" Pressure Reducing Valve
Hot Water Heater
Hot Water Supply
4" Discharge Line from Boiler Feed Pumps
3" Exhaust from Feed Water Heater Thru Roof
Plumbing Vent Thru Roof
150 H.P. Feed Water Heater
24"x 12' Air Separating Tank with Automatic Control
Engineer's Room
3" Suction Strainers
Return from Heating System
N
A
Heating Plans
Zone of Camp Activities & Amusements
Camp Funston, Kan
Piping Plan of Power Plant
Scale 3/8" = 1'-0"
Drawn by Sidney Finstein
Maj. Dick B. Foster — Chief



Blow Off Line
High Pressure Steam Supply
Vent thru Roof
Drip line from Safety Valves
4" Safety Valves
12" Steam Header
150 H.P. BOILER
Boiler Washing Water Line
150 H.P. BOILER
150 H.P. BOILER
150 H.P. BOILER
Smoke Stack
Steam for Flue Blowers
1" Cold Water Supply to Boilers
5" By Pass
5" By Pass
5"x10" Pressure Reducing Valve
5"x10" Pressure Reducing Valve
3" By Pass
3" By Pass
1" Steam Trap
15" Main Steam Supply Lines
COAL ROOM
COAL TROUGH
PLATFORM